

Electrochemical Hydrogen Refrigerator

Completed Technology Project (2017 - 2019)



Project Introduction

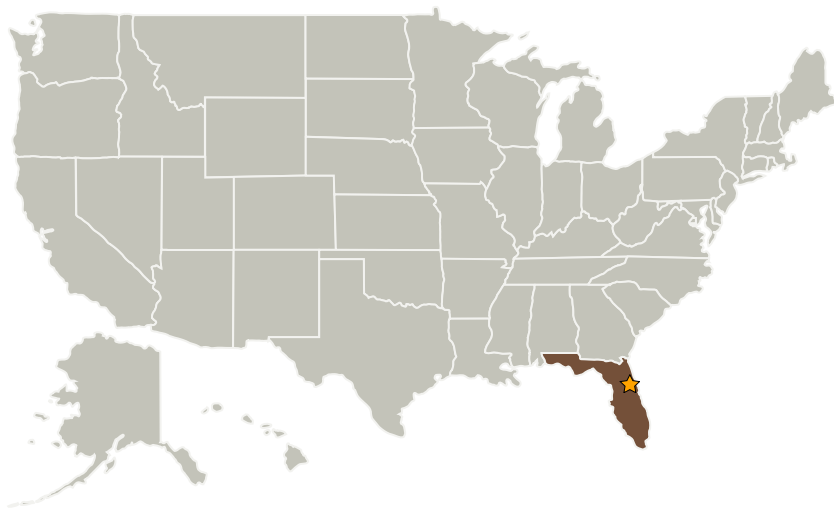
The goal is to develop and test a 1 W at 20K Joule-Thomson cryocooler using an electrochemical compressor. A Joule Thomson refrigerator based on electrochemical hydrogen compression (EHC) offers many benefits, including:

- Hydrogen has superior refrigerant properties than helium
- Hydrogen offers isothermal heat exchanger between 15K -30K
- EHC uses DC power, easy to integrate
- EHC has no moving parts: low maintenance & easy to fabricate
- EHC requires no lubrication, no oil separator systems
- EHC architecture has commonality w\ fuel cells and electrolyzer

Anticipated Benefits

Develop and test a 1 W at 20K Joule-Thomson cryocooler using an electrochemical compressor. Cryocooler development and integration are both listed as a high priority technology need in TA-14 of the OCT Roadmap. 20K cryocoolers are relevant for multiple applications including zero boil off of chemical and nuclear propellants, liquefaction of ISRU gasses, cooling of IR detectors for science missions and cooling of superconducting cables and magnets.

Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|-----------------------------------|-------------------------|-------------|-------------------------------|
| ★ Kennedy Space Center(KSC) | Lead Organization | NASA Center | Kennedy Space Center, Florida |
| Florida Solar Energy Center(FSEC) | Supporting Organization | Academia | Florida |
| Meta Vista, Inc. | Supporting Organization | Industry | |

Primary U.S. Work Locations

Florida

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Innovation Fund: KSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Barbara L Brown

Principal Investigator:

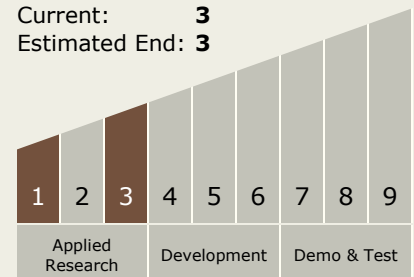
William U Notardonato

Technology Maturity (TRL)

Start: 1

Current: 3

Estimated End: 3



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Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Mars